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ABSTRACT

Management information systems have developed more rapidly than most innovations. In a relatively short period of time, the art has progressed from primitive routine clerical and accounting systems to elaborate management decisionmaking systems. Growing pains accompanied the rapid development and brought along many problems and critics. The solutions to these problems and answers to the critics have stimulated refinement of management systems. In spite of such refinements, the literature indicates that improvements in these systems are wanted, needed, and sought after; and that they are possible, necessary, and inevitable. Technical development, management science, and operations research should contribute significantly to the improvement of management information systems. An appendix contains profiles of a sample of 25 educational management information systems. A bibliography is included. (Author/JF)

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MANAGEMENT INFORMATION SYSTEMS:

THE STATE OF THE ART

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MANAGEMENT INFORMATION SYSTEMS: THE STATE OF THE ART

I. Introduction

In the last few years organizations have generally grown both in size and complexity. Expanded programs, greater service responsibility, reporting requirements, and research commitments require intricate planning and coordination to maintain a smooth operation and a continuous growth pattern. The delicate balance between planning and implementation is necessarily based upon information originating from all areas of the organizational setting (Bolin, 1971).

Head (1971) called the 1960's the "decade of the programmer," in view of the amount of attention lavished on the improvement of programming methods. There is mounting evidence that the 1970's will be the decade of the systems analyst. Given a good system definition, the programming problem becomes fairly routine--even mechanical--and therefore more amenable to automation. Now that results have been achieved at this level, interest is shifting "upstream" in the system development cycle, toward achieving greater control and discipline of system development. This evolution has necessitated the refinement of management information systems.

Most organizations have not conceived and planned their management information systems with any significant amount of attention to their intended function--providing data for decision-making. As a result, many have been disappointed with their systems. Zani (1971) claimed that management information systems traditionally have not really been designed at all, and that they have been spun off as by-products of the process of automating or improving existing systems within a company.

Van Dusseldorp (1971) described four observable approaches through which we have moved in the development of computerized information systems in education, but the scenario fits elsewhere as well. First was the applications approach used when the computer first arrived. Separate applications were put on the computer and these were primarily of a clerical nature, such as payroll, financial accounting, scheduling, grade reporting, and the like. Second came the integrated systems approach which attempted to integrate the information from various applications so that information from any one area could be related to information from each of the other areas. The third approach was the total systems approach and was an attempt to avoid duplication in gathering coding and processing data for separate systems. The fourth was the management information system approach which was developed to answer the criticism on the part of administration that information for management planning and decision-making was not being provided. The primary emphasis of this approach was providing information needed for management.

II. Definitions

Several terms are being used in this paper, the definition of which would be useful. Levin (1956) defined data as facts or statistics, unrelated and uninterpreted, whereas information is knowledge derived from the organization and analysis of data which is useful in achieving the objectives of the organization.

Hamblen (1971) defined management as the judicious use of means to accomplish an end. This is a stronger term than administration in that judicious implies "discerning" or "well-advised."

Kennevan (1970) defined a management information system (MIS) as an organized method of providing past, present and projected information relating to internal operations and external intelligence which supports the planning, control and operational function of an organization by furnishing uniform information in the proper time-frame to assist the decision-maker. Teichroew and Sayani (1971) further defined an information system as consisting of two subsystems--a management system and an information processing system. The management system consists of the organization, its objectives, the individuals or groups in it and the rules and procedures under which they work. The information processing system consists of hardware, programs, procedures, etc., that accomplish the storage, processing and communication of information necessary for the management system.

The information system should serve the management system, and both of the subsystems (information and management) should function within the total "environment" of the organization. A MIS differs from a general information system (GIS) in that a MIS organizes data into meaningful reports that are designed to fulfill defined information needs for management.

III. The State of the Art

Computer based management information systems have enjoyed a considerable measure of success, but they have also been fraught with controversy and problems. Since this is a new field and a number of growing pains have been experienced, the problems and controversy are to be expected. The first computers were developed just 25 years ago, and Van Dusseldorp (1971) tells us that they have been used for educational information systems for no more than 15 years. Today the operation of computer based educational information systems is common in state educational agencies, larger school districts, and colleges and universities. Even though we have this widespread use of management information systems, Van Dusseldorp contends that they have not been fully implemented and are only moderately successful.

Argyris (1971) described six kinds of impact on management that are due to MIS. (1) The traditional management expert limits his plans to the formal system, while the MIS expert enlarges his domain of interest to all relevant factors. The

MIS expert may ask that behavior, policies, practices, and norms that have been operating covertly be surfaced so that their contribution to the problem be made explicit. This results in the reduction of space of free movement for the traditional manager. (2) Another impact is the feeling of psychological failure by the management expert as his former primary role is assumed by machine, his daily goals and actions to accomplish these goals are planned for him, and his performance evaluated. (3) A third impact is the emphasis that management information systems place upon the use of valid information and technical competence, rather than formal power, to manage organizations. (4) As management information systems become sophisticated, there will be less need for ambiguity and self-fulfilling prophecies; the manager will not have to put things in shape, because they will be in shape. (5) A mature management information system reduced the need for organizational politics within, but especially among, departments. (6) Finally, the sophisticated management system will require a different level of intelligence and conceptual competence of managers. The historical emphasis upon power over competence and fuzziness over explicitness has naturally attracted executives with qualities different from those needed for the systems approach.

Dearden (1972) recommends five considerations toward the solution of problems in the area of MIS. First, place competent personnel in each of the formal information systems. Second,

examine the interfaces in light of adequate communications and adequately informed groups at all important interfaces. Next, examine the logistics system and ascertain that the transition from manual processing to automation is up-to-date. Fourth, a central computer group for systems control should be organized so that as computer operations continue to expand, management will maintain central control. Finally, an administrative vice-president should be created if one does not already exist so that the increasing demands of management will not be hindered by administration.

Even though management information systems have emerged at a much faster rate than most innovations, the trend seems to be that future growth will be even more rapid. As progress is made in the approach, McFarlan (1970) suggests consideration of four issues: (1) What are the advantages of top-down and bottom-up approaches to planning? (2) What level of detail can be meaningfully incorporated in plan information? (3) What should the time horizon of a sound plan be? (4) How should a company scan for outside services?

IV. The Future

There is indication in the literature that the rapid rate of development in management systems will continue and in some operations the impact may even be greater in the future. Gruber and Niles (1971) indicate that, as researchers become more concerned with basic research as opposed to applied research,

management science and operational research utilization may speed the development. As the information system itself is improved, there will be more and better hardware, software and systems. The improvements in hardware will include faster and smaller computers with compact video-display desk-top terminals. Improved software will include simple computer languages which are subsets of a spoken language. Programming will be no more than straightforward enumeration of familiar declarative and imperative sentences that tell the computer what to do (Blackwell, 1971). Interrogative sentences would be entered by the manager in order to obtain information for decision making. If his question is not clearly stated, the computer will ask for clarification. Systems improvements will likely include a more efficient expansion of time sharing, improved communication lines and computer networks.

McFarland (1970) looks forward to increased flexible integration of management information systems with service organizations who offer specialized data bases, statistical services, time-sharing services, and special program packages.

V. Summary

Management information systems have developed more rapidly than most innovations. In a relatively short period of time, the art has progressed from primitive routine clerical and accounting systems to elaborate management decision-making systems. Growing pains accompanied the rapid development and

brought along many problems and critics. The solutions to these problems and answers to the critics have stimulated refinement of management systems. In the early stage of development of the system, emphasis was placed on the improvement of programming while functions less amenable to automation were neglected. Recently, the emphasis has been toward the improvement of systems analysis and systems development.

The use of management information systems is widespread and on the increase; however, most users are not "completely" satisfied with the results. The literature indicates that improvements in these systems are wanted, needed, and sought after; and that they are possible, necessary and inevitable.

Technical development will produce better hardware at a probable lower cost to the user. This development alone should help provide better management information systems. The indication is that this development will not be alone. While progress is being made here, management science and operations research should contribute significantly to the improvement of management information systems.

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PROFILES OF A SAMPLE OF 25 EDUCATIONAL MANAGEMENT INFORMATION SYSTEMS

Name of System	Originator	Purpose
ACT Data Information Storage and Retrieval	Hubert Tolman Northeastern Louisiana State College	To collect and make available testing information for use by colleges in recruiting students.
APPLE (Ancedotal Processing to Promote Learning Experiences	Nadine Lambert The University of Calif. at Berkley	To provide data for monitoring learning and for decisopms re;e-vant to modifying the learning environment of the individual to adapt to his readiness and to improve the efficiency of the educational process.
APSS (Associated Public School Systems)	Associated Public Systems, New York, N.Y.	To develop a national network for better schools by providing a conceptual framework for school system analyses.
Computer-Based Management and Education System for Counselor Education	Janet C. Heddisheiner Ohio State University	To develop methodology to be followed in creating an information system for use in counselor education.
CAMPUS (A computer-based planning and budgeting system for universities and colleges)	Systems Research Group Toronto, Canada	To provide a means by use of a simulation model to aid the administration in relating costs of the institution to its activities and to develop procedures for comparing the costs of doing things in different ways.
CBS (Computer Budget System)	University of Maine	To provide answers to financial questions about the financial operations of the University of Maine.

Name of System	Originator	Purpose
CES (A Comprehensive Evaluation Survey)	U. S. Office of Education Washington, D. C.	To meet evaluation requirements associated with federally assisted elementary and secondary school programs.
CMR (A Comprehensive Management Review	U. S. Office of Education Washington, D. C.	To review management functions in state education agencies such as planning, project administration, financial management, personnel management, and management information systems.
CPIR (A Consolidated Program Information Report)	U. S. Office of Education Washington, D. C.	To aid local and state education agencies reporting on federally financed programs, to provide data on instructional programs and on medical and health services provided to various student populations with federal, state and local funds.
EIS-QCO (Education Information System-Quick Course Orientation)	Herbert L. Abrams Balflower School District Los Angeles, California	To explain verbally and visually the content of high school courses.
ERIC (Educational Resources Information Center)	U. S. Office of Education Washington, D. C.	To make current educational research and related information available promptly and inexpensively to teachers and administrators.
EDUCOM (Interuniversity Communications Council)	James G. Miller University of Michigan	To allow for dissemination of information about new technology, concepts, techniques, and applications of the communications science.

Name of System	Originator	Purpose
IEIC (Iowa Educational Information Center)	Iowa Educational Information Center Iowa City, Iowa	To facilitate educational research by developing and operating a centralized educational information file and to provide training for educators in educational data processing.
ISUD (The Information System for Vocational Decisions)	Center for Studies in Education and Development Graduate School of Education Harvard University	To provide vocational information to the inquirer by high speed computation.
NSRDS (National Standard Reference Data System)	Federal Council for Science and Technology Washington, D.C.	To give the technical community easy access to quantitative data on physical science.
NYSEIS (New York State Educational Information System)	New York State Dept. of Education, Albany, New York	To provide computer service for instructional purposes by developing a regional network of data processing centers.
OID (Office of Information Dissemination)	U. S. Office of Education	To increase national dissemination of information on the results of research, to help state departments of education become important links between the producers and users of knowledge gained through R & D projects, and to serve as a support center to accelerate nationwide application of tested educational improvements.
OTIS (The Oregon Total Information System)	Lowry M. Bennett, Director OTIS Eugene, Oregon	To develop a comprehensive, coordinated network which would provide computer services for local school districts, and to integrate the information required by the Office of Education.

Name of System	Originator	Purpose
PDM (Precedence Diagramming Method)	Paul A. Montello Dept. of Educational Administration Georgia State Univ.	To provide effectual cost analysis, to aid in budgeting, to hold projects to a time schedule, and to facilitate decisions for the reallocation of resources.
PDMS (Primitive Data-base Management System)	Michael S. Pliner Case Western Reserve University	To expand the concept of generalized data base management to applications where data and operations are complex and highly structured.
PLATO (Programmed Logic for Automatic Teaching Operation)	Donald L. Bitzer University of Illinois	To provide high school and college students with computer-based knowledge network.
PMIS (Planning and Management Information System)	U. S. Office of Education Washington, D. C.	To provide comprehensive information about a school system to aid in decision making.
SMOERR (A System to Meet the Office of Education Reporting Requirements)	P. S. Vivekananthan Vocational Education Evaluation Project Virginia Polytechnic Institute and State University	To develop a system which can provide information on enrollments and program completions specifically in the vocational education curriculum.
UMICS (University Management Information and Control System)	Ohio State University	To provide management with better information for controlling and planning university operations.
University of Utah MIS	University of Utah	To make available information to administrators for short-term allocation and control decisions.